

CLAIMS

1. A display apparatus comprising:

a light source unit for generating excitation light having a predetermined wavelength;

5 an optical element for modulating the excitation light generated by the light source unit for each of pixels in a two-dimensional plane; and

a fluorescent screen for receiving the excitation light modulated by the optical element at a first surface and emitting  
10 visible light from a second surface opposite to the first surface, said fluorescent screen including a layer of phosphor having an absorption coefficient not smaller than  $1 \times 10^2 \text{ cm}^{-1}$  for the excitation light.

2. A display apparatus comprising:

15 a light source unit for generating excitation light having a predetermined wavelength;

an optical element for modulating the excitation light generated by the light source unit for each of pixels in a two-dimensional plane; and

20 a fluorescent screen for receiving the excitation light modulated by the optical element at a first surface and emitting visible light from a second surface opposite to the first surface, said fluorescent screen including a layer of phosphor in which a thickness of said layer of phosphor that gives a  
25 maximum brightness caused by the excitation light is not larger

than 120 $\mu$ m.

3. A display apparatus comprising:

a light source unit for generating excitation light having a predetermined wavelength;

5 an optical element for modulating the excitation light generated by the light source unit for each of pixels in a two-dimensional plane; and

a fluorescent screen for receiving the excitation light modulated by the optical element at a first surface and emitting  
10 visible light from a second surface opposite to the first surface, said fluorescent screen including a layer of phosphor in which a product of an absorption coefficient for the excitation light and a thickness of said layer of phosphor is within a range from 1 to 8.

15 4. A display apparatus comprising:

a light source unit for generating excitation light having a predetermined wavelength;

an optical element for modulating the excitation light generated by the light source unit for each of pixels in a  
20 two-dimensional plane;

a projection lens to project the excitation light modulated by the optical element; and

a fluorescent screen for receiving the excitation light projected by the projection lens at a first surface and emitting  
25 visible light from a second surface opposite to the first

surface, said fluorescent screen including a layer of phosphor having an absorption coefficient not smaller than  $1 \times 10^2 \text{cm}^{-1}$  for the excitation light.

5. A display apparatus comprising:

5 a light source unit for generating excitation light having a predetermined wavelength;

an optical element for modulating the excitation light generated by the light source unit for each of pixels in a two-dimensional plane;

10 a projection lens to project the excitation light modulated by the optical element; and

a fluorescent screen for receiving the excitation light projected by the projection lens at a first surface and emitting visible light from a second surface opposite to the first surface, said fluorescent screen including a layer of phosphor in which a thickness of said layer of phosphor that gives a maximum brightness caused by the excitation light is not larger than  $120 \mu\text{m}$ .

6. A display apparatus comprising:

20 a light source unit for generating excitation light having a predetermined wavelength;

an optical element for modulating the excitation light generated by the light source unit for each of pixels in a two-dimensional plane;

25 a projection lens to project the excitation light

modulated by the optical element; and

a fluorescent screen for receiving the excitation light projected by the projection lens at a first surface and emitting visible light from a second surface opposite to the first surface, said fluorescent screen including a layer of phosphor in which a product of an absorption coefficient for the excitation light and a thickness of said layer of phosphor is within a range from 1 to 8.

7. A display apparatus according to claim 1, wherein a thickness of said layer of phosphor is not larger than  $120\mu\text{m}$ .

8. A display apparatus according to claim 3, wherein the thickness of said layer of phosphor is not larger than  $120\mu\text{m}$ .

9. A display apparatus according to claim 4, wherein a thickness of said layer of phosphor is not larger than  $120\mu\text{m}$ .

10. A display apparatus according to claim 6, wherein the thickness of said layer of phosphor is not larger than  $120\mu\text{m}$ .

11. A display apparatus according to claim 2, wherein the thickness of said layer of phosphor that gives a maximum brightness caused by the excitation light is not larger than  $80\mu\text{m}$ .

12. A display apparatus according to claim 5, wherein the thickness of said layer of phosphor that gives a maximum brightness caused by the excitation light is not larger than  $80\mu\text{m}$ .

13. A display apparatus according to claim 3, wherein the

product of the absorption coefficient and the thickness of said layer of phosphor is within a range from 2 to 4.

14. A display apparatus according to claim 6, wherein the product of the absorption coefficient and the thickness of said  
5 layer of phosphor is within a range from 2 to 4.

15. A display apparatus according to claim 1, wherein said phosphor includes at least one of ZnO:Zn; (Sr, Ca, Ba)<sub>5</sub>(PO<sub>4</sub>)<sub>3</sub>Cl:Eu; ZnS:Ag, Al; ZnS:Au, Ag, Al; ZnS:Cu, Au, Al; (Zn, Cd)S:Ag; (Zn, Cd)S:Cu; Y<sub>2</sub>O<sub>3</sub>:Bi, Eu; LiEuW<sub>2</sub>O<sub>8</sub>; Ca<sub>8</sub>Mg (SiO<sub>4</sub>)<sub>4</sub>Cl<sub>2</sub>:Eu,  
10 Mn; Ba<sub>2</sub>ZnS<sub>3</sub>:Mn; Y<sub>2</sub>O<sub>2</sub>S:Eu; BaMg<sub>2</sub>Al<sub>16</sub>O<sub>27</sub>:Eu; BaMg<sub>2</sub>Al<sub>16</sub>O<sub>27</sub>:Eu, Mn; BaMgAl<sub>10</sub>O<sub>17</sub>:Eu; BaMgAl<sub>10</sub>O<sub>17</sub>:Eu, Mn; Sr<sub>5</sub>(PO<sub>4</sub>)<sub>3</sub>Cl:Eu; (Sr, Ba)SiO<sub>4</sub>:Eu; SrGa<sub>2</sub>S<sub>4</sub>:Eu; K<sub>5</sub>Eu<sub>2.5</sub>(WO<sub>4</sub>)<sub>6.75</sub>; ZnS:Cu, Al; and 3.5MgO·0.5MgF<sub>2</sub>·GeO<sub>2</sub>:Mn.

16. A display apparatus according to claim 6, wherein the  
15 phosphor includes at least one of ZnO:Zn; (Sr, Ca, Ba)<sub>5</sub>(PO<sub>4</sub>)<sub>3</sub>Cl:Eu; ZnS:Ag, Al; ZnS:Au, Ag, Al; ZnS:Cu, Au, Al; (Zn, Cd)S:Ag; (Zn, Cd)S:Cu; Y<sub>2</sub>O<sub>3</sub>:Bi, Eu; LiEuW<sub>2</sub>O<sub>8</sub>; Ca<sub>8</sub>Mg (SiO<sub>4</sub>)<sub>4</sub>Cl<sub>2</sub>:Eu, Mn; Ba<sub>2</sub>ZnS<sub>3</sub>:Mn; Y<sub>2</sub>O<sub>2</sub>S:Eu; BaMg<sub>2</sub>Al<sub>16</sub>O<sub>27</sub>:Eu; BaMg<sub>2</sub>Al<sub>16</sub>O<sub>27</sub>:Eu, Mn; BaMgAl<sub>10</sub>O<sub>17</sub>:Eu; BaMgAl<sub>10</sub>O<sub>17</sub>:Eu, Mn; Sr<sub>5</sub>(PO<sub>4</sub>)<sub>3</sub>Cl:Eu; (Sr, Ba)SiO<sub>4</sub>:Eu;  
20 SrGa<sub>2</sub>S<sub>4</sub>:Eu; K<sub>5</sub>Eu<sub>2.5</sub>(WO<sub>4</sub>)<sub>6.75</sub>; ZnS:Cu, Al; and 3.5MgO·0.5MgF<sub>2</sub>·GeO<sub>2</sub>:Mn.

17. A display apparatus according to claim 1, wherein the fluorescent screen further includes second phosphor which is different from said phosphor and generates visible light upon  
25 receiving luminescent light from said phosphor.

18. A display apparatus according to claim 4, wherein the fluorescent screen further includes second phosphor which is different from said phosphor and generates visible light upon receiving luminescent light from said phosphor.

5 19. A display apparatus according to claim 17, wherein said second phosphor includes at least one of  $Y_3Al_5O_{12}:Ce$  and  $Y_3(Al, Ga)_5O_{12}:Ce$ .

20. A display apparatus according to claim 18, wherein said second phosphor includes at least one of  $Y_3Al_5O_{12}:Ce$  and  $Y_3(Al, Ga)_5O_{12}:Ce$ .

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